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TEXAS AGRICULTURAL EXPERIMENT STATION

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DIVISION OF RANGE ANIMAL HUSBANDRY

(In Cooperation with Bureau of Animal Industry and Bureau of Plant Industry, U. S. Department of Agriculture)

FATTENING BEEF CALVES ON MILO GRAIN PREPARED IN DIFFERENT WAYS

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
T. O. WALTON, President

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Experiments were conducted during the 1931-32, 1932-33, and 1933-34 feeding seasons in cooperation with the United States Department of Agriculture at its Field Station, located near Big Spring, Texas, comparing the feeding values of (1) unground threshed milo, (2) ground threshed milo, (3) unground milo heads, and (4) ground milo heads for fattening beef calves of weaning age.

Unground milo, when hogs follow the steers, is converted into more pounds of gain, beef plus pork, than is ground grain, but with the prevailing prices of beef and pork during the period of this experiment, the net returns were consistently lower in the case of the groups fed unground grain.

Unground threshed milo produced larger gains than unground milo heads. Ground threshed milo produced the largest steer gain but showed lower net returns than ground milo heads, largely because of a higher feed cost per 100 pounds gain and a slightly lower average selling price of the steers.

The groups that received the ground grain showed a decidedly higher as well as a more uniform finish and sold at higher prices on the market. The steers fed unground threshed milo made the most expensive gains and because of their uneven finish netted the smallest returns of any of the groups. Without hogs following, the spread in returns between the groups fed unground and ground grain would have been wider.

The average results for the three tests do not warrant the expense of threshing milo for cattle feeding in the milo producing area. Milo should be ground for steer fattening, whether in head or threshed form unless hogs can be used to salvage the undigested grain.

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TEXAS AGRICULTURAL EXPERIMENT STATION IN COOPERATION WITH THE BUREAU OF ANIMAL INDUSTRY AND THE BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE

Previous cattle feeding tests (1-2) at Big Spring and at other experiment stations in Texas have proved beyond any question of doubt that livestock can be finished on rations in which milo grain is used to replace corn.

The grain sorghums, as a group, are the principal feed-grain crops produced in West Texas. The production for Texas for the 1935 crop was approximately 66 million bushels (3). Milo is, at the present time, the most popular variety of grain in that area. Its grain is comparatively large, soft, and palatable, and the dwarf strains produce a high percentage of grain to stalk. The milo grain crop is harvested mostly by hand, the heads being cut from the stalks. It is commonly stored and fed on the farm in the form of heads.

It was determined by feeding lambs (4) that threshed milo, kafir, and feterita grains had approximately 95 to 98 percent the feeding value of No. 2 yellow corn. During this series of experiments, these grains were fed as whole threshed, as ground threshed, and as ground heads. In a later test (5), unground grain sorghum heads fed to fattening lambs indicated that the unground sorghum grains were as efficiently utilized by fattening lambs as were ground heads; however, sheep more thoroughly grind such small grains as the sorghums than do cattle. It has also been determined that threshed grain sorghums need not be ground for hogs (6) when the hogs are self-fed. Prior to this experiment, little investigation had been made on methods of preparation of the grain sorghums for cattle feeding.

There has been an increase in the feeding of ground grain to fattening cattle; however, the question "Does it pay to grind the sorghum grains such as milo and kafir when utilized in the cattle fattening ration?" is being asked by hundreds of farmers and stockmen. Increased utilization of sorghum grain for cattle fattening has raised questions as to methods of preparation of the grain for feeding. On farms and in feedlots in the producing region, the feeder more conveniently has these grains available in head form; the prospective feeder more distantly removed from the

grain producing area most generally purchases threshed grain from the elevators. Except for hog and poultry feeding, threshing is largely a method of preparation of the grain for sale rather than for local feeding. Preparation of sorghum grain for feeding becomes largely a problem of grinding or not grinding, either the heads or threshed grain. It involves a number of considerations, such as cost of feeds, grinding costs, market values of cattle and hogs, and also the general purpose for which feeding is done.

GENERAL PLAN OF EXPERIMENT

This experiment was planned to determine the relative feeding values of (1) unground threshed milo, (2) ground threshed milo, (3) unground milo heads, and (4) ground milo heads, when fed with cottonseed meal and chopped Sumac fodder to fattening beef calves. Tests were conducted during three consecutive years, 1931-32, 1932-33, and 1933-34. The results are discussed by years separately, in order that the reader may get a concrete picture of this study. Then the results for the three feeding trials are brought together in summary form. The experiment was conducted cooperatively at the Big Spring Field Station by the Bureau of Animal Industry and the Bureau of Plant Industry, United States Department of Agriculture, and the Agricultural Experiment Station of the Agricultural and Mechanical College of Texas.

Four representative lots of 15 head each of well-bred Hereford steer calves of weaning age were used in each of the three tests. Before the calves were divided into the respective lots, they had preliminary feeding periods of 8, 20, and 20 days for the respective years, 1931-32, 1932-33, and 1933-34. During these preliminary periods they were fed a mixture of threshed milo and milo heads, ground and unground, along with a small allowance of cottonseed meal and all the chopped Sumac fodder they would consume. Duplicate ear-tag numbers were used for identification purposes. The calves were weighed individually on three consecutive days at the beginning of each experiment and were divided after the third weighing as equally as possible with reference to size and type into four groups. The averages of the three initial and final weighings, respectively, constituted the initial and final weights. Individual weights were taken at regular 28-day intervals during each of the feeding trials. Weighing of the calves was started promptly at 1 p. m. on each designated weighing date and proceeded without interruption until all weights had been taken.

The plan of feeding was, after getting the calves onto their respective rations, to supply the milo in accordance with their appetites, since the greater consumption of the unground grain is one of the items in its value as a feed. The basis of measure for grinding feeds is usually the modulus. In these tests the modulus determinations ranged between 3.2 and 3.5. The grain portion of the rations was increased as rapidly as could be done without any tendency to throw the cattle off feed, with a view to finishing them in as short a period as possible.

Each of the four lots was fed equal amounts of cottonseed meal and equal amounts of roughage. The differences in the amount of chopped Sumac fodder consumed between the two threshed milo lots and the two milo heads lots were due to the consumption of the head stems or pomace, which the calves receiving the threshed grain did not receive. In starting the cattle on feed, increases in the concentrate feeds were made conservatively in accordance with sound feedlot practice. The calves were fed twice each day, the morning feed being given about 8 a. m. and the evening feed about 5 p. m. All refused feed was weighed back in order to obtain as accurate a record as possible of the actual feed consumed.

Cattle and Hogs Used

The calves used in all three tests were good to choice Hereford steer calves. Those used in the first year's test averaged 469 pounds per head at the beginning of the experiment, November 20, 1931. The calves used in the second year's test averaged 520 pounds per head at the beginning of the experiment, November 21, 1932, while the calves used in the third year's test averaged 455 pounds per head at the beginning of the experiment, November 22, 1933.

Sixty calves were used in each test, and they were divided as evenly as possible with respect to weight and type into four lots of 15 head each. During the first test one steer in Lot 1 died, probably from blackleg; during the second year a steer was removed from Lot 1 on account of being a chronic bloater. One steer was removed from each of the Lots 1, 2, and 3, fed unground threshed milo, ground threshed milo, and unground milo heads respectively during the third test. A steer in Lot 1 developed actinomycosis; one was removed in Lot 2 on account of nervous temperament, and one in Lot 3 on account of being a stag.

Hogs followed each group of steers. The number varied in accordance with the quantity of the milo grain and the form in which it was fed. An adequate number of hogs followed each group of steers to utilize all of the undigested grain that passed through the steers. The largest number of hogs following steers were required in the groups fed milo in unground forms. The largest number of hogs used in any lot at one time was 18 head. When ground feed was used, the number never exceeded 6 head. One third pound of a mixture of equal parts of tankage and cottonseed meal was fed daily to the hogs except for the last 28 days of the third test, when their protein supplement was limited to one-sixth pound of cottonseed meal per head daily.

Feeds Used

The feeds used in each of the three tests were of good quality. The cottonseed meal was purchased under a guarantee of 43% crude protein content; however, analyses by the State Chemist showed the protein content to be slightly below the standard during the first and third years.

The bulk of the milo utilized in this study was produced on the Big Spring Field Station farm. An amount of milo sufficient to supply the needs for approximately two weeks was prepared in advance of the feeding.

The average composition of feeds utilized in these tests is given in Table 1. Analyses of two samples taken under dates of December 12, 1931, and February 17, 1932, were made for each of the respective feeds during the first test; analyses of two samples of each of the respective feeds used in the second test were taken under dates of March 25 and June 10, 1933. During the third test, only one analysis of each of the respective feeds, sampled under date of May 5, 1934, was made.

There was only slight variation in the composition of milo in the various forms from year to year. The analyses of the Sumac fodder, however, reveal that the water content during the first year's test was considerably higher than for the second and third tests. The fodder used during each of the three tests is believed to have been of about the same quality and moisture content. Lateness in sampling dates during the second and third tests probably accounted for the low moisture content shown by the analyses. Percentages of grain content of the milo heads for the respective years as determined by the threshing of representative samples were 74 for the first, 70.6 for the second, and 80 for the third.

Table 1. Composition of feeds used during experiments

Kind of Feed	Year	Protein Percent	Fat Percent	Crude Fiber Percent	Water Percent	Ash Percent	Nitrogen Free Ext. Percent
Cottonseed meal	1931–32	42.54	8.56	11.38	6.17	4.85	26.50
	1932–33	43.97	8.26	9.62	5.67	5.43	27.05
	1933–34	41.66	11.31	9.77	4.66	5.62	26.98
	Average.	42.72	9.38	10.26	5.50	5.30	26.84
Unground threshed milo	1931–32	10.81	2.84	2.05	10.74	1.53	72.03
	1932–33	12.07	2.14	1.99	8.23	1.26	74.31
	1933–34	11.93	3.30	1.87	9.34	1.55	72.01
	Average..	11.60	2.76	1.97	9.44	1.45	72.78
Ground threshed milo	1931–32	11.48	2.71	1.99	11.72	2.05	70.05
	1932–33	11.74	2.45	2.83	8.56	1.49	72.93
	1933–34	11.94	3.11	2.12	9.05	1.73	72.05
	Average..	11.72	2.76	2.31	9.78	1.75	71.68
Unground milo heads	1931–32	10.00	2.41	6.18	10.71	3.22	67.48
	1932–33	11.25	2.31	6.81	7.61	3.25	68.77
	1933–34	11.11	2.29	6.49	9.47	3.99	66.65
	Average..	10.79	2.34	6.49	9.26	3.49	67.63
Ground Milo heads	1931–32	9.12	2.35	5.92	11.59	3.25	67.77
	1932–33	10.98	2.05	6.11	7.72	2.54	70.60
	1933–34	10.22	2.34	7.26	9.27	4.02	66.89
	Average..	10.11	2.25	6.43	9.52	3.27	68.42
Chopped Sumac fodder	1931–32	4.83	1.85	14.66	35.25	9.24	34.17
	1932–33	6.06	2.38	20.99	8.45	6.94	55.18
	1933–34	7.05	2.26	18.44	7.51	7.46	57.28
	Average..	5.98	2.16	18.03	17.07	7.88	48.88

Feed Prices

The prices used for unground milo heads and Sumac fodder were the estimated prevailing average farm prices for the region during the feeding period, and are shown in Table 2. A uniform charge of $1.25 per ton was made for grinding threshed grain and unthreshed heads, and for chopping Sumac bundles. The prices for threshed grain were based on the costs of grain, in unthreshed heads, calculated from percent of grain in heads, plus $1.00 per ton for threshing. No value was allowed for head stems or pomace. The prices for cottonseed meal, salt, and limestone flour were prices paid on purchase.

Table 2. Feed prices per ton

Feeds	1931-32	1932-33	1933-34
Unground milo heads	$ 5.00	$ 4.00	$12.00
Ground milo heads	6.25	5.25	13.25
Unground threshed milo	7.67	6.67	16.00
Ground threshed milo	8.91	7.92	17.25
Cottonseed meal	20.50	16.00	21.75
Chopped Sumac fodder	5.25	3.25	5.00
Limestone flour	23.00	25.00	14.50*
Granulated salt	16.00	20.00	15.00
Tankage	50.00	44.00	55.00

*Pulverized oyster shell.

Weather Conditions During Test

The maximum and minimum temperatures, as well as the distribution of rainfall during the experiments, are shown in Table 3.

Table 3. Weather data for period of experiments by years

Month	1931-32[1]			1932-33[2]			1933-34[3]		
	Temperature		Precipitation inches	Temperature		Precipitation inches	Temperature		Precipitation inches
	Max. °F.	Min. °F.		Max. °F.	Min. °F.		Max. °F.	Min. °F.	
November	72	31	1.85	76	22	0.0	81	36	0.0
December	70	22	1.33	74	14	3.0	83	17	0.54
January	72	21	1.12	79	23	0.11	77	20	0.31
February	85	22	3.81	80	−6	0.79	81	17	0.56
March	87	18	0.17	86	26	0.18	91	23	1.50
April	93	30	2.24	92	30	0.05	95	37	1.73
May	87	46	2.66	99	39	0.80	102	41	0.08
June	....	....	....	....	....	....	93	60	0.28
Total Precipitation			13.18			4.93			5.00

[1]November 20, 1931, to May 18, 1932—180 days.
[2]November 21, 1932, to May 24, 1933—184 days.
[3]November 22, 1933, to June 6, 1934—196 days.

EXPERIMENTAL RESULTS

The returns on milo prepared in different ways have been based not only on steer and hog gains but also on the price returned per ton of grain consumed when steer credits alone and steer credits combined with hog credits are considered.

During the period of these three tests, with cheap grain and little margin for finish on cattle, hog prices were only slightly more than fifty percent of the selling price per pound of the steers. If hog prices per 100 pounds liveweight had been relatively the same as those prevailing for fat steers, the advantages in favor of grinding the grain would probably not have been so great.

The prices which the milo returned were arrived at in the following manner: All feed costs other than that of grain were charged to the respective groups at prices shown in Table 2. The cost of these feeds plus the initial or purchase prices of steers plus marketing costs were then deducted from the gross returns per steer, hog credit included. They were also deducted from the gross returns per steer alone. The remaining income was credited to milo and calculated in each instance on a per ton basis. It will be noted that all of the profits or losses of the enterprise are accounted for in the value assigned to the milo.

Results 1931-32

The average daily rations and gains by 28-day periods and for the entire 180 days are presented in Table 4. A complete summary of the first year's test, including initial and final weights of the steers, total gain per steer, hog gain per steer, cost of gains, dressed yields, carcass weights, and profit or loss per steer, is shown in Table 5.

Comparison of Unground and Ground Threshed Milo

Steers that were fed ground threshed milo (Lot 2) made approximately 16 percent greater gain, at a saving of 19 percent in grain required to produce 100 pounds gain in liveweight, than steers that received unground threshed milo (Lot 1). The steers that received the ground milo also had considerably better finish than those receiving the unground grain, which increased their selling price about 10 percent. The higher selling price seems to be warranted by the better dressed yields and carcass grades, Tables 5 and 19. When considered from the standpoint of total returns per steer, which included the returns from the hog gains per steer, unground threshed milo made a return of only 75 cents per ton while ground threshed milo made a return of $5.91 per ton. This is a difference of $5.16 per ton in favor of ground threshed milo. If the returns for steers only are considered, unground threshed milo was used at a loss of $2.01 per ton, and ground threshed milo made a return of $5.21 per ton, or $7.22 per ton more than the unground threshed milo.

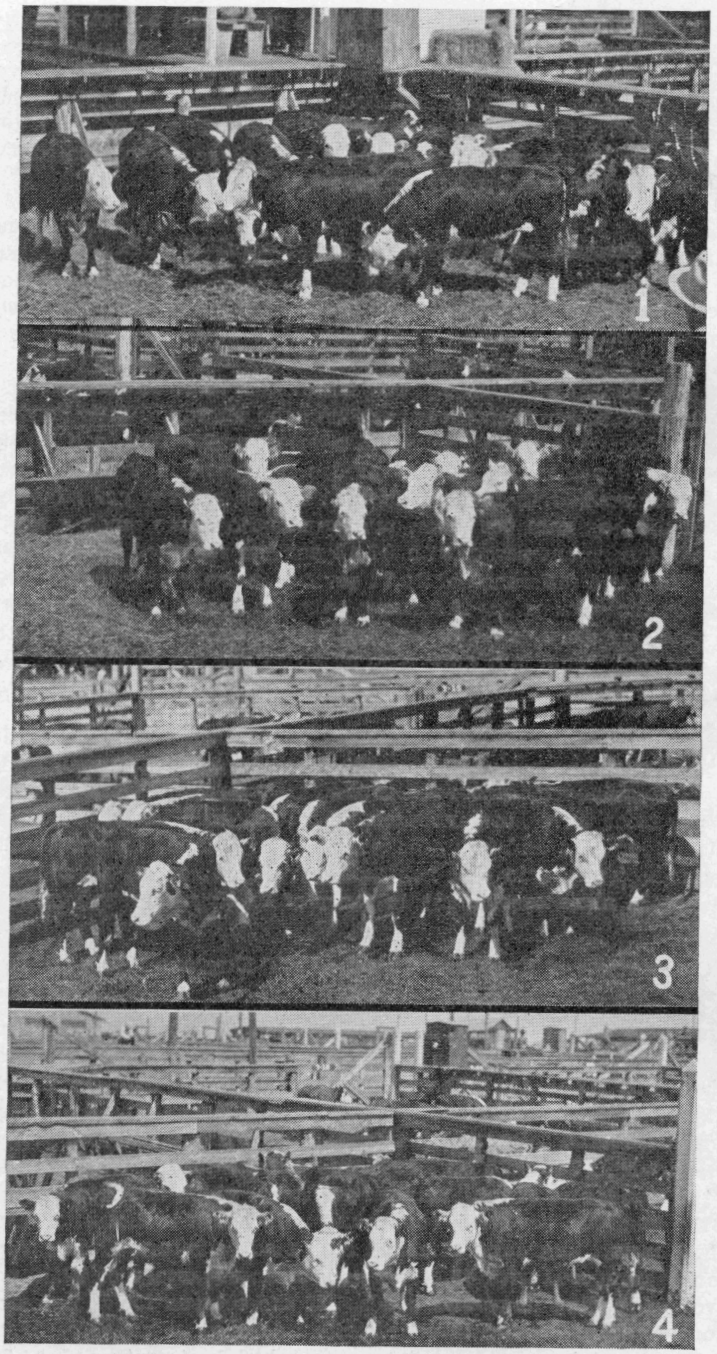

Figure 1. Showing 1931-32 finished steers at Fort Worth market.
(1) Lot 1, fed unground threshed milo.
(2) Lot 2, fed ground threshed milo.
(3) Lot 3, fed unground milo heads.
(4) Lot 4, fed ground milo heads.

The average gain per head made by the steers fed unground threshed milo during the 180-day period (Table 11) was 315 pounds as compared with 364 pounds made by steers fed ground threshed milo. When average hog gains per steer have been included, unground threshed milo produced 415 pounds of gain as compared with 390 pounds produced by ground threshed milo, or an advantage, when gain alone is considered, of 25 pounds in favor of unground threshed milo.

Comparison of Unground and Ground Milo Heads

Steers that were fed ground milo heads (Lot 4) gained approximately 18 percent more, at a saving of 20 percent in grain required to produce 100 pounds of gain in liveweight, than steers fed unground milo heads (Lot 3), as shown in Table 5. The steers that received the ground milo heads finished better than those receiving the unground milo heads; this increased their unit selling price 7.5 percent, which was justified by the better dressed yields and carcass grades as shown in Tables 5 and 19. When considered from the standpoint of total returns per steer, which included the hog gain per steer, unground milo heads made a return of $2.69 per ton as compared with $7.46 per ton returned by ground milo heads. This is a difference of $4.77 per ton in favor of grinding the milo heads. If the returns for the steers only are considered, unground milo heads made a return of $1.00 per ton, while ground milo heads returned $7.05 per ton. This is a difference of $6.05 per ton in favor of feeding ground milo heads.

The average gain per head produced by unground milo heads during the 180-day feeding period (Table 11) was 315 pounds as compared with 371 pounds gained by steers fed ground milo heads. When average hog gains per steer have been included, unground milo heads produced 401 pounds (steer gain and hog gain per steer combined) as compared with 393 pounds (steer gain and hog gain per steer), or an advantage of 8 pounds (gain alone considered) in favor of feeding unground milo heads.

Comparison of Unground Threshed and Unground Milo Heads

Steers that were fed unground milo heads (Lot 3), grain converted to a threshed basis, made gain equal that produced by steers fed unground threshed milo (Lot 1). The steers fed unground milo heads sold at approximately 5 percent more per 100 pounds liveweight than those fed unground threshed milo, which increase, according to dressed yields and carcass grades (Tables 5 and 19), was not justified. When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer (unground milo heads in Lot 3, adjusted to threshed basis), unground threshed milo made a return of only 75 cents per ton as compared with $3.63 per ton, or an advantage of $2.88 per ton in favor of feeding unground heads. If the returns for the steers only are considered, unground threshed milo was used at a loss of $2.01 per ton. Unground heads adjusted to a threshed basis returned $1.34 per

ton, or an advantage of $3.35 per ton, steer returns alone considered, in favor of feeding unground heads.

The average gain per steer produced by the unground threshed milo and unground milo heads respectively during the period of the first test (Table 11) was 315 pounds. When average hog gains per steer have been included, however, unground threshed milo produced 415 pounds total steer gain and hog gain per steer as compared with 401 pounds total gain produced by unground milo heads, or an advantage when gain alone is considered of 14 pounds in favor of feeding unground threshed milo.

Comparison of Ground Threshed and Ground Milo Heads

Steers that were fed ground milo heads (Lot 4) made a 2 percent greater gain than those fed ground threshed milo (Lot 2), and on account of a slightly higher finish as shown by dressed yields and carcass grades (Tables 5 and 19), the steers fed ground milo heads out-sold those fed ground threshed milo by approximately 2.7 percent per 100 pounds live-weight. When considered from the standpoint of total return per steer, which included those from the hog gain per steer (ground milo heads in Lot 4 adjusted to threshed basis) ground threshed milo made a return of $5.91 per ton while ground milo heads made a return of $10.08 per ton.

Table 4. Average daily rations and gains by periods in pounds, 1931-32

Lot No.	Ration and Gain	First 28-day period	Second 28-day period	Third 28-day period	Fourth 28-day period	Fifth 28-day period	Sixth 28-day period	Seventh 12-day period	Average 180-day period
1	Unground threshed milo	5.15	8.61	9.19	9.88	11.08	12.21	13.04	9.60
	Cottonseed meal	1.56	2.00	1.77	1.73	1.83	2.00	1.99	1.83
	Sumac fodder	14.97	13.15	12.14	11.98	9.84	7.81	7.77	11.39
	Salt	.04	.03	.04	.04	.04	.04	.05	.04
	Limestone flour	.09	.11	.11	.10	.12	.10	.10	.11
	Total gain per head	66.45	33.43	56.43	41.50	54.21	49.00	14.55	315.00
	Average daily gain	2.37	1.19	2.02	1.48	1.94	1.75	1.21	1.75
2	Ground threshed milo	5.15	8.61	9.19	9.73	10.85	9.69	10.47	8.97
	Cottonseed meal	1.56	2.00	1.77	1.73	1.83	2.00	1.98	1.83
	Sumac fodder	14.97	13.16	12.11	11.72	9.66	7.81	7.77	11.32
	Salt	.03	.04	.04	.08	.04	.10	.09	.06
	Limestone flour	.09	.11	.11	.10	.12	.10	.10	.11
	Total gain per head	76.38	44.53	58.74	46.40	69.93	54.07	14.07	364.00
	Average daily gain	2.72	1.59	2.09	1.66	2.50	1.93	1.17	2.02
3	Unground milo heads	6.80	11.48	12.25	13.18	15.39	17.29	17.67	13.06
	Cottonseed meal	1.56	2.00	1.77	1.73	1.83	2.00	1.98	1.83
	Sumac fodder	13.98	10.20	8.96	8.55	6.07	3.47	3.39	8.20
	Salt	.02	.04	.05	.08	.06	.10	.12	.06
	Limestone flour	.09	.11	.11	.10	.12	.10	.10	.11
	Total gain per head	70.62	32.93	51.33	43.73	52.07	45.93	17.67	315.00
	Average daily gain	2.52	1.18	1.83	1.56	1.86	1.64	1.47	1.75
4	Ground milo heads	6.86	11.48	12.20	13.16	14.94	13.65	15.67	12.29
	Cottonseed meal	1.56	2.00	1.76	1.73	1.83	2.00	1.98	1.82
	Sumac fodder	13.96	9.85	8.95	8.55	5.92	4.36	3.89	8.29
	Salt	.03	.04	.04	.05	.04	.06	.06	.04
	Limestone flour	.09	.11	.11	.10	.12	.10	.10	.11
	Total gain per head	79.62	50.13	55.07	63.00	56.34	50.73	16.33	371.00
	Average daily gain	2.84	1.79	1.96	2.25	2.01	1.81	1.36	2.06

Table 5. Summary of results of first test, 1931-32. Nov. 20, 1931, to May 18, 1932, inclusive, 180 days

Item	Lot 1 Unground Threshed Milo	Lot 2 Ground Threshed Milo	Lot 3 Unground Milo Heads	Lot 4 Ground Milo Heads
Number of steers	14	15	15	15
Average initial weight at feedlot, lbs.	471	468	468	468
Average final weight at feedlot, lbs.	786	832	783	839
Average market weight at Ft. Worth, lbs.	765	800	753	816
Average gain per head, feedlot weights, lbs.	315	364	315	371
Average gain per head, market weights, lbs.	294	332	285	348
Average daily gain per head, feedlot weights, lbs.	1.75	2.02	1.75	2.06
Average daily gain per head, market weights, lbs.	1.63	1.84	1.58	1.93
Average shrink. in transit, Big Spring-Ft. Worth, lbs.	21	32	30	23
Average shrink. in transit, Big Spring-Ft. Worth, %	2.67	3.85	3.83	2.74
Total feed consumed per steer, lbs.:				
Milo	1728	1615	2351	2212
Cottonseed meal	329	329	329	328
Sumac (red top) fodder	2050	2037	1475	1491
Salt	7	10	11	8
Limestone flour	19	19	19	19
Feed required per cwt. gain, feed cons., feed lot wts.:				
Milo	548	444	746	596
Cottonseed meal	104	90	105	88
Sumac (red top) fodder	650	560	468	402
Cost of feed per cwt. gain, feed lot wts.	$ 4.97	4.45	4.27	3.90
Cost of feed per cwt., gain, market wts.	$ 5.32	4.87	4.70	4.16
Carcass wts., cold, lbs.	432.1	474.6	428.9	486.9
Carcass wts., hot, lbs.	441	484	438	497
Dressed yield (chilled), basis 2% shrinkage:				
Basis feedlot wts., percent	55	57.1	54.8	58
Basis market wts., percent	56.5	59.3	56.9	59.7
Hogs following steers:				
Hog gain per steer, lbs.	100	26	86	22
Supplementary feed consumed by hogs:				
Tankage, per head daily, lbs.	.17	.17	.17	.17
Cottonseed meal, per head daily, lbs.	.17	.17	.17	.17
Hog feed cost per steer	$ .61	.21	.61	.21
FINANCIAL STATEMENT:				
Initial cost per steer at 6c per lb.	$ 28.25	28.08	28.10	28.09
Cost of feed per steer	15.65	16.22	13.43	14.48
Shipping & marketing cost per steer	3.48	3.48	3.48	3.48
Total cost per steer	47.38	47.78	45.01	46.05
Necessary selling price per cwt. to break even	6.19	5.97	5.98	5.64
Actual selling price per cwt.	5.10	5.60	5.35	5.75
Price received per steer	39.02	44.78	40.30	46.92
Profit or loss per steer, not incl. hog credit	−8.36	−2.98	−4.71	.88
Hog credit per steer, less hog feed cost	2.39	.57	1.99	.45
Total price received per steer, incl. hog credit	41.41	45.35	42.29	47.37
Net profit or loss per steer, incl, pork credit	−5.97	−2.41	−2.72	1.32

Selling price of hogs per cwt., $3.00.

This is a difference of $4.17 per ton in favor of feeding ground milo heads. If the returns for the steers only are considered, ground threshed milo returned $5.21 per ton. Ground milo heads, adjusted to threshed basis, returned $9.53 per ton, which was an advantage of $4.32 per ton in favor of feeding ground milo heads.

The average gain per head produced by ground threshed milo during the 180-day period (Table 11) was 364 pounds as compared with 371 pounds gain per steer for the group fed ground milo heads. When average hog gain per steer has been included, ground threshed milo produced 390 pounds (combined steer gain and hog gain per steer) as compared with 393 pounds (on the same basis), or an advantage of only 3 pounds in favor of feeding ground milo heads.

Results 1932-33

The average daily rations and gains by 28-day periods and for the entire 184 days are presented in Table 6. A complete summary of the entire test, including initial and final weights of steers, gains per steer, hog gains per steer, costs of gains, dressed yields, carcass weights, and profits per steer, is given in Table 7.

Comparison of Unground Threshed and Ground Threshed Milo

Steers that were fed ground threshed milo (Lot 2) in the second test of the series made a 10 percent greater gain, at a saving of approximately 12 percent in grain required to produce 100 pounds steer gain, than steers that received unground threshed milo (Lot 1), as shown in Table 7. The steers that received the ground threshed milo showed a better finish than those receiving the unground grain; this increased their selling price about 2.7 percent, an amount justified by dressed yields and carcass grades, as shown in Tables 7 and 19. When considered from the standpoint of total returns per steer, which included returns from the hogs per steer, unground threshed milo made a return of $18.85 per ton, while ground threshed milo made a return of $20.85 per ton. This is a difference of $2.00 per ton in favor of feeding ground threshed milo. If the returns for steers only are considered, unground threshed milo returned $14.77 per ton as compared with $19.64 per ton returned by the steers fed ground

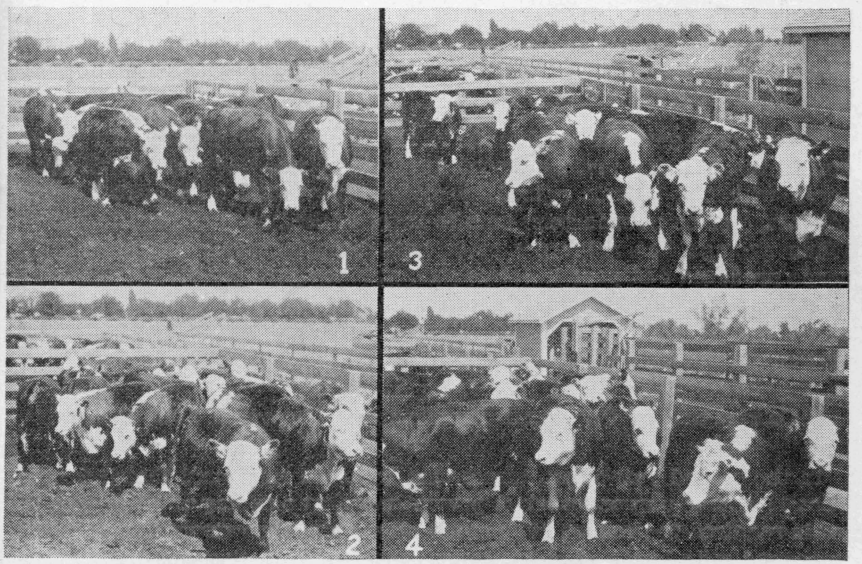

Figure 2. Showing 1932-33 finished steers in feedlots, U. S. Experiment Station, before shipment to market.
(1) Lot 1, fed unground threshed milo.
(2) Lot 2, fed ground threshed milo.
(3) Lot 3, fed unground milo heads.
(4) Lot 4, fed ground milo heads.

threshed milo, or a difference of $4.87 in favor of grinding the threshed grain. The average gain per head produced by the steers fed unground threshed milo during the 184-day period (Table 11) was 376 pounds as compared with 414 pounds gained by steers fed ground threshed milo, or an advantage of 38 pounds in favor of ground threshed milo. When average hog gains per steer have been included, unground threshed milo produced 496 pounds (combined steer gain and hog gain per steer) as compared with 450 pounds produced by ground threshed milo, or an advantage of 46 pounds, gain alone considered, in favor of feeding unground threshed milo.

Comparison of Unground and Ground Milo Heads

In the second test, steers that were fed ground milo heads in Lot 4 gained approximately 13 percent more, at a saving of about 16 percent in milo heads required to produce 100 pounds gain in liveweight, than steers fed unground milo heads in Lot 3, as shown in Table 7. The steers that were fed ground milo heads showed a higher finish than those receiving the unground milo heads and sold at a price per pound that was 4 percent higher than was paid for those fed unground milo heads. This price was justified as shown by dressed yields and carcass grades (Tables 7 and 19). When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer, unground milo heads made a return of $13.16 per ton, while ground milo heads made a return of $15.75 per ton. This is a difference of $2.59 per ton in favor of grinding the milo heads. If the returns on the steers only are considered, unground milo heads made a return of $10.26 per ton, while ground milo heads returned $14.90 per ton. This is a difference of $4.64 per ton in favor of feeding ground milo heads.

The average gain per head made by the steers fed unground milo heads during the 184 day feeding period (Table 11) was 344 pounds, as compared with 390 pounds gained by steers fed ground milo heads, or an advantage of 46 pounds steer gain in favor of feeding ground milo heads. When average hog gains per steer have been included, unground milo heads produced 468 pounds (steer gain and hog gain per steer combined) as compared with 426 pounds (steer gain and hog gain per steer), or an advantage of 42 pounds (gain alone considered) in favor of feeding unground milo heads.

Comparison of Unground Threshed and Unground Milo Heads

In the second year's test, steers that were fed unground threshed milo (Lot 1) gained approximately 9 percent more, at a saving of 12 percent in grain required to produce 100 pounds steer gain, than steers that received unground milo heads (Lot 3), grain converted to a threshed basis. The steers fed unground milo heads sold at 7 cents per hundred weight higher than those receiving unground threshed milo; this, according to dressed yields and carcass grades as shown in Tables 7 and 19, was not justified. When considered from the standpoint of total returns per steer, which

included the returns from the hog gain per steer (unground milo heads, Lot 3, adjusted to threshed basis), unground threshed milo made a return of $18.85 per ton while unground milo heads returned $18.64 per ton. This is a difference of only 21 cents per ton in favor of feeding unground threshed milo. If the returns for the steers only are considered, $14.77 per ton was returned for unground threshed milo. Unground milo heads adjusted to a threshed basis returned $14.52 per ton, or an advantage of only 25 cents per ton, steer returns alone considered, in favor of feeding unground threshed milo.

The average gain per head made by the steers fed unground threshed milo during the 184-day feeding period (Table 11) was 376 pounds as compared to 344 pounds gained by steers fed unground milo heads, or a difference of 32 pounds in favor of group fed unground threshed milo. When the average hog gains per steer have been included, unground threshed milo produced 496 pounds (steer and hog gain per steer combined) as compared with 468 pounds (steer gain and hog gain per steer) by those fed unground milo heads, or an advantage of 28 pounds in favor of unground threshed milo.

Comparison of Ground Threshed and Ground Milo Heads

In the second year's test, steers that were fed ground threshed milo (Lot 2) made approximately 6 percent greater gain, at a saving of 7.6 percent in grain required to produce 100 pounds steer gain, than steers that received ground milo heads (Lot 4), as shown in Table 7. The steers that were fed ground milo heads sold at a 2.5 percent higher price per 100 pounds liveweight than those that received ground threshed milo; this, according to dressed yields and carcass grades (Tables 7 and 19), was not justified.

When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer (ground milo heads, Lot 4, adjusted to threshed basis), ground threshed milo made a return of $20.85 per ton, while ground milo heads made a return of $22.30 per ton, or an advantage of $1.45 per ton in favor of feeding the grain in the form of ground milo heads. If the returns for the steers only are considered, $19.64 per ton was returned by ground threshed milo. Ground milo heads adjusted to a threshed basis returned $21.10 per ton, which was an advantage of $1.46 per ton in favor of feeding ground milo heads.

The average gain per head made by the steers fed ground threshed milo during the 184 day period (Table 11) was 414 pounds as compared with 390 pounds gained by steers fed ground milo heads, a difference of 24 pounds in favor of ground threshed milo. When average hog gains per steer have been included, ground threshed milo produced 450 pounds total gain as compared with 426 pounds produced by ground milo heads, or an advantage of 24 pounds in favor of ground threshed milo.

Results 1933-34

The average daily rations and gains by 28-day periods and for the entire 196 days are presented in Table 8. A complete summary of the test, including initial and final weights of the steers, total gain per steer, hog gain per steer, cost of gains, dressed yields, carcass weights, and profits or losses, is shown in Table 9.

Table 6. Average daily rations and gains by periods in pounds, 1932-33

Lot No.	Ration and Gain	First 28-day period	Second 28-day period	Third 28-day period	Fourth 28-day period	Fifth 28-day period	Sixth 28-day period	Seventh 16-day period	Average 184-day period
1	Unground threshed milo	4.98	8.04	8.75	9.37	11.02	12.58	14.41	9.58
	Cottonseed meal	1.66	2.00	2.00	2.00	2.03	2.28	2.24	2.02
	Sumac fodder	10.71	10.50	11.41	12.00	11.10	9.36	8.00	10.60
	Salt	.05	.02	.02	.03	.03	.02	.01	.03
	Limestone flour	.11	.10	.11	.11	.09	.10	.09	.10
	Total gain per head	53.39	48.78	64.07	61.86	58.00	62.43	27.43	376.00
	Average daily gain	1.91	1.74	2.29	2.21	2.07	2.23	1.71	2.04
2	Ground threshed milo	4.79	7.39	8.40	9.27	11.15	12.28	13.98	9.32
	Cottonseed meal	1.66	2.00	2.00	2.00	2.03	2.28	2.23	2.02
	Sumac fodder	10.71	10.50	11.40	12.00	11.10	9.33	8.00	10.59
	Salt	.08	.04	.02	.04	.04	.03	.03	.04
	Limestone flour	.11	.10	.11	.11	.09	.09	.09	.10
	Total gain per head	56.09	54.46	78.40	68.74	62.40	66.80	27.42	414.00
	Average daily gain	2.00	1.94	2.80	2.45	2.23	2.39	1.71	2.25
3	Unground milo heads	6.95	11.59	13.67	14.53	15.52	18.58	21.46	14.17
	Cottonseed meal	1.66	2.00	2.00	2.00	2.03	2.28	2.23	2.02
	Sumac fodder	8.65	6.99	7.28	7.63	6.41	3.75	1.54	6.33
	Salt	.06	.03	.02	.03	.04	.04	.03	.03
	Limestone flour	.11	.10	.11	.11	.09	.09	.09	.10
	Total gain per head	42.51	51.27	55.67	55.20	53.00	56.33	29.82	344.00
	Average daily gain	1.52	1.83	1.99	1.97	1.89	2.01	1.86	1.87
4	Ground milo heads	6.63	9.39	12.07	13.75	16.10	18.68	20.65	13.46
	Cottonseed meal	1.66	2.00	2.00	2.00	2.03	2.28	2.23	2.02
	Sumac fodder	8.75	7.64	7.74	7.85	6.26	3.73	1.82	6.54
	Salt	.08	.07	.05	.07	.05	.03	.03	.06
	Limestone flour	.11	.10	.11	.11	.09	.09	.09	.10
	Total gain per head	37.93	61.53	71.60	58.00	66.80	70.27	23.69	390.00
	Average daily gain	1.35	2.20	2.56	2.07	2.39	2.51	1.48	2.12

Comparison of Unground Threshed and Ground Threshed Milo

In the third test steers fed ground threshed milo (Lot 2) made only 1.6 percent greater gain, at a saving of 6 percent in grain required to produce 100 pounds steer gain, than steers that received unground threshed milo (Lot 1). Grinding resulted in an increased finish and increased the selling price per 100 pounds liveweight 8 percent, an amount that was hardly justified by dressed yields and carcass grades (Tables 9 and 19).

When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer, unground threshed milo returned $14.35 per ton, while ground threshed milo made a return of $18.25 per ton. This is a difference of $3.90 per ton in favor of ground threshed milo. If the returns per steer only are considered, unground

Table 7. Summary of results of second test. Nov. 21, 1932, to May 24, 1933, inclusive, 184 days

Item	Lot 1 Unground Threshed Milo	Lot 2 Ground Threshed Milo	Lot 3 Unground Milo Heads	Lot 4 Ground Milo Heads
Number of steers	14	15	15	15
Average initial weight at feedlot, lbs.	520	519	519	524
Average final weight at feedlot, lbs.	896	933	863	914
Average market weight at Ft. Worth, lbs.	838	878	811	868
Average gain per head, feedlot weights, lbs.	376	414	344	390
Average gain per head, market weights, lbs.	318	359	292	344
Average daily gain per head, feedlot weights, lbs.	2.04	2.25	1.87	2.12
Average daily gain per head, market weights, lbs.	1.73	1.95	1.59	1.87
Average shrink. in transit, Big Spring-Ft. Worth, lbs.	58	55	51	46
Average shrink. in transit, Big Spring-Ft. Worth, %	6.49	5.92	5.95	5.01
Total feed consumed per steer, lbs.:				
Milo	1763	1715	2606	2476
Cottonseed meal	371	371	371	371
Sumac (red top) fodder	1950	1949	1164	1204
Salt	5	7	6	11
Limestone flour	19	19	19	19
Feed required per cwt. gain, feed cons. feedlot wts.:				
Milo	469	414	758	635
Cottonseed meal	99	90	108	95
Sumac (red top) fodder	519	471	339	309
Cost of feed per cwt. gain, feedlot weights	$ 3.27	3.20	3.02	3.02
Cost of feed per cwt. gain, market weights,	$ 3.87	3.69	3.54	3.42
Carcass weights, cold, lbs.	501.1	531.8	485.2	519.5
Carcass weights, hot, lbs.	511.4	542.6	495.1	530.1
Dressed yield (chilled), basis 2% shrinkage:				
Basis feedlot weights, percent	55.9	57.0	56.2	56.8
Basis market weights, percent	59.8	60.6	59.8	59.8
Hogs following steers:				
Hog gain per steer, lbs.	120	36	124	36
Supplementary feed consumed by hogs:				
Tankage per head daily, lbs.	.17	.17	.17	.17
Cottonseed meal, per head daily, lbs.	.17	.17	.17	.17
Hog feed cost per steer	$ .90	.31	.86	.30
FINANCIAL STATEMENT:				
Initial cost per steer at 5.1c per lb.	26.54	26.47	26.46	26.74
Cost of feed per steer	12.31	13.23	10.36	11.77
Shipping & marketing cost per steer	3.46	3.46	3.46	3.46
Total cost per steer	42.31	43.16	40.28	41.97
Necessary selling price per cwt. to break even	5.05	4.92	4.97	4.84
Actual selling price per cwt.	5.90	6.06	5.97	6.21
Price received per steer	49.45	53.21	48.44	53.92
Profit or loss per steer, not including pork credit	7.14	10.05	8.16	11.95
Hog credit per steer, less hog feed cost	3.60	1.04	3.79	1.05
Total price received per steer., incl. hog credit	53.05	54.25	52.23	54.97
Net profit per steer, including pork credit	10.74	11.09	11.95	13.00

Hog selling price per cwt., $3.75.

threshed milo returned $12.42 per ton, while ground threshed milo made a return of $17.78, or $5.36 per ton more than the unground threshed milo.

The average gain per head made by the steers fed unground threshed milo during the 196 day period was 428 pounds (Table 11) as compared with 435 pounds made by steers fed ground threshed milo, or an advantage of only 7 pounds in favor of grinding. When average hog gains per steer have been included, unground threshed milo produced 539 pounds steer gain and hog gain per steer, as compared with 462 produced by ground threshed milo, or an advantage of 77 pounds, gain alone considered, in favor of unground threshed milo.

Comparison of Unground and Ground Milo Heads

In the third test, steers that were fed ground milo heads (Lot 4) made approximately 4 percent greater gain, at a saving of approximately 12

percent in grain required to produce 100 pounds gain, than steers that received unground milo heads (Lot 3). The steers that received the ground milo heads finished better than those receiving the unground grain and sold at an 8 percent higher price per 100 pounds liveweight, an amount justified by higher dressed yields and better carcass grades (Tables 9 and 19).

When considered from the standpoint of total returns per steer, which included the returns from the hog gains per steer, unground milo heads returned $9.42 per ton, while ground milo heads made a return of $12.81

Table 8. Average daily rations and gains by periods in pounds, 1933-34

Lot No.	Ration and Gain	First 28-day period	Second 28-day period	Third 28-day period	Fourth 28-day period	Fifth 28-day period	Sixth 28-day period	Seventh 28-day period	Average 196-day period
1	Unground threshed milo	5.15	7.38	8.14	8.37	12.51	13.25	15.36	10.02
	Cottonseed meal	1.10	1.56	1.98	2.00	2.19	2.29	2.29	1.91
	Sumac fodder	12.60	12.14	11.60	10.89	10.27	8.57	7.56	10.52
	Salt	.03	.03	.02	.02	.01	.01	.01	.02
	Pulverized oyster shell	.08	.11	.14	.11	.09	.10	.10	.10
	Total gain per head	55.76	59.71	62.72	52.14	77.64	55.21	65.62	428.00
	Average daily gain	1.99	2.13	2.24	1.86	2.77	1.97	2.34	2.19
2	Ground threshed milo	4.51	6.68	7.08	7.85	12.89	13.71	14.22	9.56
	Cottonseed meal	1.10	1.56	1.97	2.00	2.20	2.28	2.29	1.91
	Sumac fodder	12.53	12.14	11.57	10.91	10.29	8.65	7.56	10.52
	Salt	.04	.03	.03	.03	.02	.02	.02	.03
	Pulverized oyster shell	.08	.11	.14	.11	.09	.10	.10	.10
	Total gain per head	51.34	60.57	54.85	62.15	81.57	59.86	65.19	435.00
	Average daily gain	1.83	2.16	1.96	2.22	2.91	2.14	2.33	2.22
3	Unground milo heads	6.26	8.81	9.45	10.00	14.27	16.19	18.78	11.96
	Cottonseed meal	1.10	1.56	1.98	2.00	2.19	2.27	2.27	1.91
	Sumac fodder	11.07	10.36	9.71	8.90	7.40	5.47	3.96	8.13
	Salt	.03	.02	.02	.03	.02	.02	.02	.02
	Pulverized oyster shell	.08	.11	.14	.11	.09	.10	.10	.10
	Total gain per head	46.53	47.14	49.00	52.71	63.71	56.29	49.14	364.00
	Average daily gain	1.66	1.68	1.75	1.88	2.28	2.01	1.76	1.86
4	Ground milo heads	6.32	8.18	8.74	9.34	14.17	14.71	15.57	11.00
	Cottonseed meal	1.10	1.56	1.97	1.99	2.19	2.23	2.27	1.90
	Sumac fodder	11.04	10.46	9.84	8.99	7.43	5.68	4.60	8.29
	Salt	.04	.03	.03	.03	.02	.02	.02	.03
	Pulverized oyster shell	.08	.11	.14	.11	.10	.10	.10	.10
	Total gain per head	52.78	51.20	50.80	51.74	71.46	55.73	44.67	379.00
	Average daily gain	1.88	1.83	1.81	1.85	2.55	1.99	1.60	1.93

per ton, or an advantage of $3.39 per ton in favor of grinding. If the returns for steers only are considered, unground milo heads returned $7.80 per ton, while ground milo heads made a return of $12.66 per ton, or an advantage of $4.86 per ton in favor of grinding the milo heads.

The average gain per head made by the steers fed unground milo heads during the 196-day period was 364 pounds as compared with 379 pounds made by those receiving ground milo heads, an advantage of 15 pounds steer gain in favor of grinding. When average hog gains per steer have been included, unground milo heads produced 475 pounds total gain as compared with 395 pounds total gain made by the animals fed ground

Table 9. Summary of results of third test. Nov. 22, 1933, to June 6, 1934, inclusive, 196 days

Item	Lot 1 Unground Threshed Milo	Lot 2 Ground Threshed Milo	Lot 3 Unground Milo Heads	Lot 4 Ground Milo Heads
Number of steers	14	14	14	15
Average initial weight at feedlot, lbs.	456	457	454	454
Average final weight at feedlot, lbs.	884	892	818	833
Average market weight at Ft. Worth, lbs.	832	841	775	791
Average gain per head, feedlot weights, lbs.	428	435	364	379
Average gain per head, market weights, lbs.	376	384	321	337
Average daily gain per head, feedlot weights, lbs.	2.19	2.22	1.86	1.93
Average daily gain per head, market weights, lbs.	1.92	1.96	1.64	1.72
Average shrink. in transit, Big Spring-Ft. Worth, lbs.	52	51	43	42
Average shrink. in transit, Big Spring-Ft. Worth, %	5.88	5.72	5.26	5.04
Total feed consumed per steer, lbs.:				
Milo	1964	1874	2345	2157
Cottonseed meal	375	375	374	373
Sumac (red top) fodder	2061	2062	1593	1625
Salt	4	5	4	5
Pulverized oyster shell	20	20	20	20
Feed required per cwt. gain, feed cons., feedlot wts.:				
Milo	459	431	644	569
Cottonseed meal	88	86	103	98
Sumac (red top) fodder	481	474	437	430
Cost of feed per cwt. gain, feedlot weights	$ 5.81	5.82	6.07	5.90
Cost of feed per cwt. gain, market weights	$ 6.62	6.60	6.89	6.64
Carcass weights, cold, lbs.	484.7	501.8	445.6	468.3
Carcass weights, hot, lbs.	494.6	512.1	454.6	477.9
Dressed yield (chilled), basis 2% shrinkage:				
Basis feedlot weights, percent	54.8	56.2	54.4	56.3
Basis market weights, percent	58.2	59.7	57.5	59.2
Hogs following steers:				
Hog gain per steer, lbs.	111	27	111	16
Supplementary feed consumed by hogs:				
Tankage per head daily, lbs.	.14	.14	.14	.14
Cottonseed meal per head daily, lbs.	.17	.17	.17	.17
Hog feed cost per steer	$ .88	.24	.87	.23
FINANCIAL STATEMENT:				
Initial cost per steer at 5.5c per lb.	$ 25.03	25.10	24.92	24.94
Cost of feed per steer	25.18	25.56	22.34	22.61
Shipping & marketing cost per steer	3.46	3.49	3.28	3.34
Total cost per steer	53.67	54.15	50.54	50.89
Necessary selling price per cwt. to break even	6.45	6.44	6.52	6.44
Actual selling price per cwt.	6.02	6.50	5.88	6.35
Price received per steer	50.09	54.67	45.57	50.23
Profit or loss per steer, not including pork credit	−3.58	.52	−4.97	−.66
Hog credit per steer, less hog feed cost*	1.89	.44	1.90	.17
Total price received per steer, incl. pork credit	51.98	55.11	47.47	50.40
Net profit or loss per steer, incl. pork credit	−1.69	.96	−3.07	−.49

*Hog selling price per cwt., $2.50.

milo heads, or an advantage of 80 pounds in favor of unground heads, gain alone considered.

Comparison of Unground Threshed and Unground Milo Heads

In the third test, steers that were fed unground threshed milo (Lot 1) gained approximately 18 percent more, at a saving of 11 percent in grain required to produce 100 pounds steer gain, than steers that were fed unground milo heads (Lot 3), grain converted to a threshed basis. The steers fed unground threshed milo sold at a 2.4 percent higher price per 100 pounds liveweight than those that received unground milo heads. This difference as indicated by dressed yields and carcass grades (Tables 9 and 19) seems warranted. When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer (unground milo heads, Lot 3, adjusted to threshed basis), unground

threshed milo made a return of $14.35 per ton, while unground milo heads made a return of $11.78 per ton. This is a difference of $2.57 per ton in favor of feeding the milo in the unground threshed form. If the returns for the steers only are considered, $12.42 per ton was returned for unground threshed milo. Unground milo heads adjusted to a threshed basis returned $9.75 which is an advantage of $2.67 per ton in favor of feeding unground threshed milo.

The average gain per head made by the steers fed unground threshed milo during the 196-day feeding period (Table 11) was 428 pounds as compared with 364 pounds gained by steers fed unground milo heads, or a difference of 64 pounds in favor of steers fed unground threshed milo. When the average hog gains per steer have been included, unground threshed milo produced 539 pounds (steer gain and hog gain combined) per steer as compared with 475 pounds (steer gain and hog gain per steer) by those fed unground milo heads, or an advantage of 64 pounds in favor of feeding unground threshed milo.

Comparison of Ground Threshed and Ground Milo Heads

In the third test, steers that were fed ground threshed milo (Lot 2) gained approximately 6 percent more, at a saving of 5 percent in grain required to produce 100 pounds steer gain, than steers that received ground milo heads (Lot 4). The steers that were fed ground threshed milo sold at a 2.4 percent higher price per 100 pounds liveweight than those that were fed ground milo heads; this, according to dressed yields and carcass grades, was not justified.

When considered from the standpoint of total returns per steer, which included the returns from the hog gain per steer (ground milo heads, Lot 4, adjusted to threshed basis), ground threshed milo made a return of $18.25 per ton while ground milo heads made a return of $16.01 per ton. This is a difference of $2.24 per ton in favor of feeding the grain in the ground threshed form. If the returns for the steers only are considered, ground threshed milo returned $17.78 per ton. Ground milo heads adjusted to threshed basis returned $15.82 per ton, which was an advantage of $1.96 per ton in favor of feeding the ground threshed grain.

The average gain per head made by the steers fed ground threshed milo during the 196 day period (Table 11) was 435 pounds as compared with 379 pounds gained by the steers fed ground milo heads, a difference of 56 pounds in favor of ground threshed milo. When average hog gains per steer have been included, ground threshed milo produced 462 pounds total gain as compared with 395 pounds produced by ground milo heads, or an advantage of 67 pounds gain in favor of feeding the ground threshed milo.

DISCUSSION OF RESULTS

These experiments to determine the relative feeding values of threshed milo and milo heads in both ground and unground forms were started in

the fall of 1931 and continued through three successive fall and winter feeding periods. Sumac fodder and cottonseed meal were fed with milo in the various forms to four groups of good to choice feeder steer calves for an average feeding period of 187 days for the three experiments.

The duration of the respective feeding periods and the average daily feed consumption and steer gains under the different methods of preparation of the grain for the three tests are shown in Table 10. The total concentrate and roughage consumption (milo heads in Lots 3 and 4 adjusted to threshed basis and head stems included as roughage for these two groups for purposes of comparison) in relation to efficiency of gains in live weight under the various methods of preparation are shown in Table 11. Average steer gains, and steer gains plus hog gains per 100 pounds of feed, are shown in Table 12.

Table 10. Average feed consumed daily per steer; daily gains per steer, and per 1000 pounds live weight

Lot	Year	No. steers	No. days on feed	Grain		Cottonseed meal, lbs.	Sorgo (Red top) Fodder lbs.	Average initial wt., lbs.	Average final wt., lbs.	Av. daily gains-lbs.	
				Kind	Lbs.					Per head	Per 1000 lbs. live-weight
1	1931–32	14	180	Unground	9.60	1.83	11.39	471	786	1.75	2.78
	1932–33	14	184	threshed	9.58	2.02	10.60	520	896	2.04	2.88
	1933–34	14	196	milo	10.02	1.91	10.52	456	884	2.19	3.27
				Av. (weighted)..	9.74	1.92	10.83	482	856	2.00	2.97
2	1931–32	15	180	Ground	8.97	1.83	11.32	468	832	2.02	3.11
	1932–33	15	184	threshed	9.32	2.02	10.59	519	933	2.25	3.10
	1933–34	14	196	milo	9.56	1.91	10.52	457	892	2.22	3.29
				Av. (weighted)..	9.29	1.92	10.81	482	886	2.16	3.16
3	1931–32	15	180	Unground	13.06	1.83	8.20	468	783	1.75	2.80
	1932–33	15	184	milo	14.17	2.02	6.33	519	863	1.87	2.71
	1933–34	14	196	heads	11.96	1.91	8.13	454	818	1.86	2.92
				Av. (weighted)..	13.07	1.92	7.54	481	821	1.82	2.81
4	1931–32	15	180	Ground	12.29	1.82	8.29	468	839	2.06	3.15
	1932–33	15	184	milo	13.46	2.02	6.54	524	914	2.12	2.95
	1933–34	15	196	heads	11.00	1.90	8.29	454	833	1.93	3.00
				Av. (weighted)..	12.22	1.91	7.71	482	862	2.04	3.04

Comparison of Unground and Ground Threshed Milo

In a study to evaluate the grinding of threshed milo as between Lot 1, fed unground threshed milo, and Lot 2, fed ground threshed milo (as shown in Table 11 covering the three tests), ground threshed milo produced 57 pounds more steer gain per ton consumed than did the unground grain. But the unground threshed milo produced 88 pounds more hog gain per ton of grain consumed than did Lot 2, leaving an advantage of 31 pounds of net gain, basis feedlot weights, in favor of feeding the unground threshed grain. When steer gains alone are considered, one ton

of ground threshed milo as compared with unground threshed grain fed to Lot 2 resulted in a saving of 270 pounds of grain, 31 pounds of cottonseed meal, and 200 pounds of Sumac fodder over the Lot 1 requirements. However, when hog gains are included, one ton of unground threshed milo fed to Lot 1 resulted in a saving of 128 pounds of grain, 43 pounds of cottonseed meal, and 250 pounds of Sumac fodder.

Comparison of Unground and Ground Milo Heads

In a similar comparison between Lots 3 and 4 fed unground and ground milo heads respectively (not shown on head basis in Table 11), the average results of the three tests showed that the ground milo heads produced 53 pounds more steer gain per ton of ground milo heads than did the unground milo heads. But the unground heads produced 67 pounds more hog gain per ton of milo heads consumed than did the ground heads, leaving an advantage of 14 pounds net gain, basis feedlot weights, in favor of feeding the unground milo heads. When steer gains alone are considered, one ton of ground milo heads (head basis) compared with unground milo resulted in a saving of 380 pounds of milo heads, 37 pounds of cottonseed meal, and 117 pounds of Sumac fodder. However, when hog gains have been included, one ton of unground milo heads resulted in a saving of 74 pounds of milo heads, 29 pounds of cottonseed meal, and 151 pounds of Sumac fodder.

Table 11. Total grain and roughage consumed and gains in live weight for animals for the different groups

Lot No.	Year	Days on feed	Total feeds consumed			Total gains for period			Total gain per ton grain consumed			Steer gain per ton rough-age
			Grain[1]	C.S. meal[2]	Rough-age[3]	Gain per steer	Hog gain per steer	Steer plus hog gain	Gain per steer	Hog gain per steer	Steer plus hog gain	
1. Fed Unground Threshed Milo	1931–32	180	1728	329	2050	315	100	415	365	116	480	308
	1932–33	184	1763	371	1950	376	120	496	427	136	563	386
	1933–34	196	1964	375	2061	428	111	539	436	113	549	416
	Av....	187	1818	358	2020	373	110	483	409	122	531	370
2. Fed Ground Threshed Milo	1931–32	180	1615	329	2037	364	26	390	451	32	483	358
	1932–33	184	1715	371	1949	414	36	450	483	42	525	424
	1933–34	196	1874	375	2062	435	27	462	464	29	493	422
	Av....	187	1735	358	2016	404	30	434	466	34	500	400
3,* Fed Unground Milo Heads	1931–32	180	1740	329	2086	315	86	401	362	99	461	302
	1932–33	184	1841	371	1930	344	124	468	374	135	508	356
	1933–34	196	1876	371	2062	364	111	475	388	118	506	352
	Av....	187	1819	358	2026	341	107	448	375	117	492	336
4,* Fed Ground Milo Heads	1931–32	180	1637	328	2066	371	22	393	453	27	480	360
	1932–33	184	1748	371	1932	390	36	426	446	41	487	404
	1933–34	196	1726	373	2056	379	16	395	439	19	458	368
	Av....	187	1704	357	2018	380	25	405	446	29	475	376

[1]Grain adjusted to threshed basis, Lots 3 and 4.
[2]Does not include one-third lb. mixture, equal parts cottonseed meal and tankage, fed per head daily to hogs.
[3]Head stems included in roughage for Lots 3 and 4.
*Milo heads consumed by Lots 3 and 4 shown head basis in Tables 5, 7, and 9.
Threshing percentages: First year, 74%; second year, 70.6%; third year, 80%.

Comparison of Ground Threshed and Ground Milo Heads

In a study to evaluate the threshing of milo as between Lots 2 and 4, fed ground threshed and ground milo heads, respectively, the average results of the three tests, with milo heads in Lot 4 converted to a threshed

Table 12. Average feed consumed per 100 pounds of gain for the years 1931-32, 1932-33, and 1933-34[1]

Lot No.	Steer gain alone			Steer + hog gain[2]		
	Grain lbs.	Cotton-seed meal lbs.	Sumac fodder lbs.	Grain lbs.	Cotton-seed meal lbs.	Sumac fodder lbs.
Lot 1, Fed Unground Threshed Milo.....	487	96	542	376	74	418
Lot 2, Fed Ground Threshed Milo.....	429	89	499	400	82	465
Lot 3, Fed Unground Milo Heads.....	714	105	414	406	80	452
Lot 4, Fed Ground Milo Heads.....	600	94	379	421	88	498

[1]Does not include supplementary feed consumed by the hogs.
[2]Grain adjusted to threshed basis and head stems included as roughage, Lots 3 and 4.

basis, showed that Lot 2 produced 20 pounds more steer gain and 5 pounds more hog gain per ton of grain consumed, or a net advantage of 25 pounds in favor of grinding and threshing. When the steer gains alone are considered, one ton of ground threshed milo fed to Lot 2 resulted in a saving of 89 pounds of grain, threshed basis, and 23 pounds of cottonseed meal, but required an additional 489 pounds of Sumac fodder above that required by Lot 4. With hog gains included for the three years (milo heads, Lot 4, adjusted to threshed basis), one ton of ground threshed milo fed to Lot 2 resulted in a saving of 110 pounds of grain and 30 pounds of cottonseed meal, but required 645 pounds of Sumac fodder more than that required by Lot 4.

Comparison of Unground Threshed and Unground Milo Heads

In a comparison between Lots 1 and 3, fed unground threshed and unground milo heads respectively, the average results of the three tests, with milo heads in Lot 3 converted to threshed basis, showed that Lot 1 produced 34 pounds more steer gain and 5 pounds more hog gain per ton of grain consumed, or a net advantage of 39 pounds in favor of feeding the unground threshed grain. When the steer gains alone are considered, one ton of unground threshed milo fed to Lot 1 as compared with unground heads adjusted to threshed basis fed to Lot 3 resulted in a saving of 189 pounds of grain and 37 pounds of cottonseed meal, but required an additional 526 pounds of Sumac fodder. When hog gains are included for the three years, one ton of unground threshed milo fed to Lot 1 as compared with Lot 3, threshed basis, resulted in a saving of 160 pounds of grain and 32 pounds of cottonseed meal, but required an additional 548 pounds of Sumac fodder.

Advantages for Grinding

There are two comparisons in each feeding trial (Table 13) which afford measurements of the value of grinding. The advantages for grinding per ton of grain consumed are calculated from the net differences in financial return between compared lots when all costs are charged against the lots, except the cost of the milo, on a basis of steer credit plus hog credit and on steer credit only.

Table 13. Advantages for grinding, three tests, 1931-1934

Item	Year	Steer gain increased, %	Grain required to produce cwt. steer gain, reduced, %	Selling price steers per cwt., increased, %	Differences in returns per ton of grain consumed, Basis:	
					Steer credits plus hog credits	Steer credits only
Comparison of Unground (Lot 1) and Ground (Lot 2) Threshed Milo....	1931–32	16.0	19.0	9.8	$ 5.16	$ 7.22
	1932–33	10.0	12.0	2.7	2.00	4.87
	1933–34	1.6	6.0	8.0	3.90	5.36
Comparison of Unground (Lot 3) and Ground (Lot 4) Milo Heads.....	1931–32	18.0	20.0	7.5	4.77	6.05
	1932–33	13.0	16.0	4.0	2.59	4.64
	1933–34	4.0	12.0	8.0	3.39	4.86

High returns from grinding in 1931-32 resulted from poor performance of the steers fed the unground forms of milo. The results for the second trial, 1932-33, were intermediate between the first and third trials, in which unground threshed milo produced better, and ground milo heads poorer, results than in any of the other trials.

With other conditions equal, the advantage for grinding increases with the cost of milo grain and beef prices, since less ground than unground grain is required to produce a cwt. of steer gain. On the average, returns were slightly greater for grinding the threshed milo than for grinding milo heads. The returns from grinding were greater than the estimated cost of grinding ($1.25 per ton) with or without hogs following the steers.

As shown in Tables 5, 7, and 9, it actually paid to grind the grain in these three feeding tests when hog prices happened to be considerably below those for finished beef steers. However, when quotations on fat hogs are relatively in line with prices being paid for finished steers as at the present time (1937), the advantages in favor of grinding the grain would be considerably narrowed. In these tests the steers that were fed ground grain finished better and sold at approximately one-half cent per pound more on the Fort Worth market than those that received the unground grain.

Advantages for Threshing

As in the evaluation of grinding, there are two comparisons in each feeding trial which afford measurements of the value of threshing. These

values are shown in Table 14 and are calculated by the same method as in Table 13.

Table 14. Advantages for threshing, three tests, 1931-1934

Item	Year	Steer gain increased, %	Grain required to produce cwt. steer gain, reduced, %	Selling price steers per cwt., increased, %	Differences in returns per ton of grain consumed, Basis:	
					Steer credits plus hog credits	Steer credits only
Comparison of Unground Threshed (Lot 1) and Unground Milo heads (Lot 3)	1931–32	.....	.....	−5.0	−$ 2.88	−$ 3.35
	1932–33	9.3	12.0	−1.19	.21	.25
	1933–34	17.6	11.0	2.4	2.57	2.67
Comparison of Ground Threshed (Lot 2) and Ground Milo Heads (Lot 4)	1931–32	−1.9	.....	−2.7	−4.17	−4.32
	1932–33	6.1	7.6	−2.5	−1.45	−1.46
	1933–34	14.8	5.3	2.4	2.24	1.96

On the average, threshed grains produced more steer gain and at a saving in the amount of grain required to produce a cwt. of gain. In 1931-32 the financial return was decidedly unfavorable for threshing and only in the last year were the results favorable. The major difference in the feeding of these compared lots was that Sumac fodder replaced head stems (pomace) in the ration, the latter being removed by threshing. While the gains, dressed yields, and carcass grades indicate that Sumac fodder was a better roughage than head stems, the returns show that at the values charged for Sumac fodder the head stems could not be discarded without loss, even if no charge were made for threshing. There was less return for threshing with grinding (Lots 2 and 4 compared) than for threshing without grinding (Lots 1 and 3 compared). The use of hogs did not materially affect the results of comparisons between threshing and not threshing.

Comparative Productive Energy

During the 1933-34 test the productive energy of milo as fed in the different forms and based on average steer gains alone for the three tests (Table 15), and also as based on the combined steer and hog gains (Table 16), were calculated by Dr. G. S. Fraps, Chief of the Division of Chemistry. The productive energy was also calculated from the average chemical composition of the feeds (Table 1) used in the three experiments and the production coefficients given in Texas Station Bulletin 329. Maintenance requirements for cattle and hogs shown by Armsby in "The Nutrition of Farm Animals" were used.

The methods of calculation of the productive energy of the milo in the various forms fed in these experiments are shown in Tables 15 and 16. Ground threshed milo was used as a standard with a calculated productive value of 85.8 therms per 100 pounds. The productive value of ground

threshed milo as determined from five lamb feeding experiments at Spur and shown in Table 16, Texas Station Bulletin 379, was found to be 85.9 therms.

As shown in Table 15, the unground threshed milo (based on steer performance alone) in this experiment had a productive value of 73.6 therms per 100 pounds, when compared with a calculated productive value of 85.8 for ground threshed milo. With lambs in the test referred to above, unground threshed milo showed a value of 81.4 therms. Unground milo heads, when steer gains alone are considered, showed a productive value of 58.0 therms per 100 pounds, while the value of ground milo heads, steer gain alone considered, was 69.7 therms. Grinding the milo heads increased their efficiency by 20 percent. Milo heads in the lamb feeding test previously referred to showed a value of 79.9 therms. The productive value for ground milo heads per 100 pounds in the steer feeding test reported in this bulletin was 6.2 therms below the productive value obtained by the same method in a steer feeding test at Spur and shown in Table 9, Texas Station Bulletin 296. In that test an average of 8.27 pounds of ground milo heads was used as compared with 12.22 pounds used in this test. This comparison indicates that a greater efficiency in the use of the grain resulted when steers were limited to the lower level.

In the calculation of the productive values of milo in the various forms based on the combined steer and hog gains as shown in Table 16, it was assumed that all the feed secured by the hogs from the steer droppings came from the milo. The values secured by use of the hogs are probably a little high, as some of the feed eaten by them may have come from the undigested cottonseed meal and sumac fodder. From these calculations it is shown that the approximate productive energy value of 100 pounds unground threshed milo based on combined steer and hog gains was increased from 73.6 therms for steers alone to 101.7 therms, or 38 percent, while that of ground threshed milo was increased from 85.5 therms based on steer gains alone to 94 therms, or approximately 10 percent, when hog gains have been included. The productive value of 100 pounds unground milo heads was increased from 58 therms, steer gains alone considered, to 79.2 therms, or about 37 percent, on the basis of the combined gains of both steers and hogs, while the productive value of ground milo heads for steers alone was 69.7 therms as compared with 73.8 therms, or an advantage of about 6 percent when combined steer and hog gains are taken into consideration.

Salt Consumption

Granulated salt was kept before the steers at all times. The average daily salt consumption per head during each of the three tests is shown in Table 17.

Shrinkage in Transit and Slaughter

Table 18 shows that the shrinkage in transit ranged from 2.67 percent to 6.49 percent of the weight of the animal. The shrinkage was lowest

Table 15. Calculation of productive energy for steers fed milo grain in different forms from average of three experiments

	Unground threshed milo	Ground threshed milo	Unground milo heads	Ground milo heads
Average weights (pounds W)	669	684	651	672
Average daily gain (pounds G)	1.99	2.16	1.83	2.04
Daily feeds, pounds C. S. meal	1.92	1.92	1.92	1.91
sorgo fodder	10.83	10.81	7.54	7.72
unground threshed milo	9.74	.....	.....	.....
ground threshed milo	.....	9.29	.....	.....
unground milo heads	.....	.....	13.07	.....
ground milo heads	.....	.....	.....	12.22
Productive value, therms, c.s.m. (.785)	1.51	1.51	1.51	1.50
sorgo fodder (.360)	3.90	3.89	2.71	2.78
ground threshed milo (.858)	.....	7.97	.....	.....
Total therms T	5.41	13.37	4.22	4.28
Maintenance, therms W × .0066 = M	4.42	4.51	4.30	4.44
Productive value of gain T — M = B	.....	8.86	.....	.....
Therms for 1 pound gain B ÷ G = K	.....	4.10	.....	.....
Productive energy of gain K × G = L	8.16	.....	7.50	8.36
Productive energy of ration M + L = O	12.58	.....	11.80	12.80
Productive energy of milo O — T = E	7.17	.....	7.58	8.52
Productive value of 100 pounds milo. E ÷ wt. milo × 100	73.6	.....	58.0	69.7
Productive value, calculated from analysis	*	85.5	*	78.3

*Factors not available for calculation.

Table 16. Calculation of productive energy of milo grain for different forms based on gains of steers and of hogs for 1933-34 test only

		Lot 1	Lot 2	Lot 3	Lot 4
(A)	Average daily gain of hogs per steer day	0.56	0.14	0.57	0.08
(B)	Average daily weight of hogs per steer day	103.3	30.5	102.7	26.1
(C)	Productive energy required for gain of hogs (A x 3.0)	1.68	0.42	1.71	0.24
(D)	Productive energy required for maintenance of hogs (Bx.012)	1.24	0.37	1.23	0.31
(E)	Total productive energy required by hogs (C + D)	2.92	0.79	2.94	0.55
(F)	Cottonseed meal	0.14	0.04	0.13	0.03
(G)	Tankage	0.11	0.03	0.11	0.03
(H)	Total daily feed of hogs	0.25	0.07	0.24	0.06
(I)	Productive energy in cottonseed meal (Fx .785)	0.110	0.031	0.102	0.024
(K)	Productive energy in tankage (Gx .60)	0.066	0.018	0.066	0.018
(L)	Total productive enery (I + K)	0.176	0.049	0.168	0.042
(M)	Approximate productive energy from steer feed (E – L)	2.744	0.741	2.772	0.508
(O)	Productive energy of milo from feeding to steers	7.17	7.97	7.58	8.52
(P)	Total productive value, steers and hogs (Assuming all the feed secured by the hog from the steer droppings came from the milo)	9.91	8.71	10.35	9.02
(R)	Pounds of milo fed	9.74	9.29	13.07	12.22
(S)	Approximate productive energy (therms per 100 lbs. feed) of milo for both steers and hogs (P ÷ R) 100	101.75	93.76	79.19	73.81

Table 17. Average daily consumption of salt per head

Year	Number days on feed	Lot 1, fed unground threshed milo, ounces	Lot 2, fed ground threshed milo, ounces	Lot 3, fed unground milo heads, ounces	Lot 4, fed ground milo heads, ounces
1931-32	180	.602	.933	1.013	.693
1932-33	184	.420	.641	.542	.916
1933-34	196	.315	.437	.362	.422
Average for three years		.442	.669	.657	.671

Table 18. Shrinkage in transit and slaughter data

Lot	Grain used	Year	Skrinkage		Average weight dressed carcasses,* pounds	Dressing percentage (less 2% shrink)	
			Per head, pounds	Percent		Basis feedlot weights, %	Basis market weights, %
1	Unground threshed milo	1931–32	21	2.67	432.1	55.0	56.5
		1932–33	58	6.49	501.1	55.9	59.8
		1933–34	52	5.88	484.7	54.8	58.2
2	Ground threshed milo	1931–32	32	3.85	474.6	57.1	59.3
		1932–33	55	5.92	531.8	57.0	60.6
		1933–34	51	5.72	501.8	56.2	59.7
3	Unground milo heads	1931–32	30	3.83	428.9	54.8	56.9
		1932–33	51	5.95	485.2	56.2	59.8
		1933–34	43	5.26	445.6	54.4	57.5
4	Ground milo heads	1931–32	23	2.74	486.9	58.0	59.7
		1932–33	46	5.01	519.5	56.8	59.8
		1933–34	42	5.04	468.3	56.3	59.2

*Cold carcass weight.

Table 19. Number of beef carcasses in various grades

Year	Lot	Grades				
		Choice	Good	Medium	Fair	Condemned
1931-32	1	1	2	8	3	..
	2	3	4	3	5	..
	3	..	4	7	4	..
	4	5	6	3	1	..
1932-33	1	..	14	..	..	..
	2	5	10	..	..	..
	3	1	14	..	..	..
	4	5	10	..	..	..
1933-34	1	9	2	3	..	..
	2	10	3	..	..	1
	3	3	5	6	..	..
	4	11	3	1	..	..

during the first year, 1931-32 and was highest during the second year, 1932-33. In the first year, Lot 1 (fed unground threshed milo) had the lowest shrinkage and Lot 2 (fed ground threshed milo) had the highest. During the next two years, Lot 1 (fed unground threshed milo) showed the heaviest shrinkage while Lot 4 (fed ground milo heads) showed the least. As between Lots 1 and 2, the latter had the lowest shrinkage two out of the three years. In a comparison between Lots 3 and 4, the latter showed the lowest shrinkage in each of the three years. The cattle were shipped a distance of 267 miles.

In each of the three years the average dressed yield of the steers fed ground threshed milo was higher than that for the steers fed unground threshed milo. The average dressed yield of the steers fed ground milo

heads was higher during each of the three years than that of the steers fed unground milo heads.

As is shown in Table 19, the carcasses of the Lot 2 steers (fed ground threshed milo) graded higher in each of the three tests than those of Lot 1 (fed unground threshed milo), and likewise the carcasses of Lot 4 (fed ground milo heads) graded higher than those of the Lot 3 steers (which received unground milo heads) in each of the three tests.

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SUMMARY

1. The results of the three feeding trials reported in this bulletin show that the average gain made by the steers fed unground milo was 357 pounds as compared with 392 pounds for those fed ground milo. This is an advantage of 35 pounds gain per steer in favor of ground milo. But when gain per steer and hog gain per steer were combined, the advantage was reversed in favor of feeding unground grain. The average steer gain and hog gain per steer for the groups fed the unground milo was 465 pounds as compared with 419 pounds made by those fed ground milo. This is an advantage of 46 pounds per steer (hog gain included) in favor of unground milo.

2. The grain, when fed either threshed or in the head form, should be ground for fattening steer calves when it is not practical to follow the cattle with thrifty feeder pigs.

3. Steer calves of weaning age fattened in dry lot on either ground threshed or ground milo heads gained faster, finished better, and commanded a higher selling price after a six-months feeding period than similar steers fed on unground milo grain in either threshed or head form.

4. The average steer gain produced by ground milo (Lots 2 and 4) as compared with unground milo (Lots 1 and 3) was highly significant in favor of grinding.

5. The average steer gain produced by threshed milo (Lots 1 and 2) was significantly greater than that produced by steers fed unthreshed milo (Lots 3 and 4).

6. Grinding increased gains and finish to a greater extent than did threshing.

7. The greatest gain and highest finish was produced by ground threshed milo; however, considering the usual price relation between

milo grain and roughage, the advantages for threshing may not be great enough to warrant the expense of threshing and the waste of the head stems or pomace.

8. A feeding period of six months was sufficient to produce good to choice finish on steer calves when ground milo was fed, but was not sufficient when the milo was unground.

9. Hog gains per steer in the groups fed unground milo were approximately four times as great as those made by hogs following steers fed ground milo. However, considering the exceptionally low hog prices that prevailed during these experiments, the value of the total gains was greater when the ground grain was fed.

10. In these three trials, even with very cheap grain and little margin for finish in cattle, financial returns favored grinding; however, hog gains per pound were credited at only slightly more than fifty percent of the selling price per pound of the steers. If hog prices per 100 pounds live weight had been relatively the same as those prevailing for fat steers, the advantage in favor of grinding would not have been so great.

11. Although grinding the grain resulted in significant increases in steer gain, finish, and prices received, the accompanying data covering this study do not indicate that it is always profitable to grind the grain. The alternative method would be to salvage grain undigested by following the steers with hogs. This offers possibilities to the small stock farmer who is not equipped for grinding. In general the quality of pork produced should be improved by some additional feeding away from the cattle.

12. The small operator who is not equipped to grind may, under normal conditions, market his unground milo through fattening steers followed by a sufficient number of thrifty feeder pigs to utilize waste and undigested grain. Feeder pigs weighing around 75 pounds at the beginning of the feeding operations can be used to follow feedlot steers fed unground milo grain when normal prices for beef and pork prevail. In this feeding test, 1 to 1.2 feeder pigs per steer were required for efficient utilization of the waste and undigested milo grain in instances where unground milo was fed. However, when ground milo grain was fed, more efficient use of the grain was made by the steers and only 0.2 pig per steer was required to utilize the waste or undigested grain.

LITERATURE CITED

1. Jones, J. M., Black, W. H., and Keating, F. E. 1927. Sorgo Silage, Sorgo Fodder and Cottonseed Hulls as Roughages in Rations for Fattening Calves. Tex. Sta. Bul. 363.
2. Black, W. H., Jones, J. M., and Keating, F. E. 1928. Sorgo Silage, Sorgo Fodder, and Cottonseed Hulls as Roughages in Rations for Fattening Calves in the Southwest. USDA Tech. Bul. 43.
3. Grain Sorghums. USDA Crops and Markets, December 1935, Vol. 12, No. 12, p. 492.
4. Jones, J. M. and Dickson, R. E. 1928. Grain Sorghums Vs. Corn for Fattening Lambs. Tex. Sta. Bul. 379.
5. Jones, J. M., McDowell, C. H., and Jones, J. H. 1933. Feeding Unground Vs. Ground Grain Sorghum Heads. Tex. Sta. Mimeo. Summary Lamb Feeding Series No. 2.
6. Hale, Fred 1931. Feeding Value of Grain Sorghums and Methods of Feeding. Tex. Sta. Forty-Fourth Annual Report, p. 84.